

**ADOPTION OF BIOSECURITY FOR DISEASE PREVENTION AND CONTROL BY  
 POULTRY FARMERS IN IMO STATE, NIGERIA**

**Tasie, C. M., Wilcox, G. I. and Kalio, A. E.**

*Department of Agricultural Science (Agricultural Economics and Extension Unit)*

*Faculty of Vocational and Technical Education*

*Ignatius Ajuru University of Education, Rumuolumeni, Port Harcourt, Rivers State, Nigeria*

**Corresponding Author Email:** [tasiechimezie@gmail.com](mailto:tasiechimezie@gmail.com) 08038726818

**ABSTRACT**

*The study assessed the adoption of biosecurity for disease prevention and control by poultry farmers in Imo State. The objectives of study were to: ascertain the socio - economic characteristics of poultry farmers in Imo State; identify sources of information on biosecurity measures adopted by poultry farmers for disease prevention and control in Imo State; ascertain biosecurity measures adopted by poultry farmers for disease prevention and control in Imo State; determine factors influencing adoption of biosecurity practices. A research survey of 60 owners and managers of poultry farms was used. A multi-stage sampling technique was used to select samples for the study and data were analysed using descriptive and inferential statistics (Logit regression). The study revealed that most of the poultry farmers in the study area were male and married and that these farmers were still in their active and productive age and most of them were educated. Majority of the poultry farmers in the study area were micro and small scale farmers and have considerable experience in poultry production and are members of farmers' groups with profit motive as their farming enterprise objective. Majority of the poultry farmers had training in livestock management and most of the respondents did not receive any extension visit for the past two years up to the date of data collection and that the practice of biosecurity in the study area is high. Farmers association, veterinary officers, Internet and researchers are the significant sources of information on biosecurity to the poultry farmers in the study area. Age, cooperative membership, experience in poultry farming, training, farm size, education and access to credit significantly influenced the adoption of biosecurity practices in the study area. Any increase in the level of these variables would increase the level of adoption of biosecurity practices for disease prevention and control in the study area. Based on the findings of this study, it is recommended that aggressive sensitization of the poultry farmers through seminars, workshops and conferences by relevant authorities on the advantages of adoption of biosecurity measures in their farms and encouraging fellow farmers to do so.*

**Key words:** Adoption, biosecurity, disease, prevention, control, poultry farmers

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## **INTRODUCTION**

Livestock farming contributes to people's livelihoods through numerous channels: income, food, employment and transport, draft power, manure, savings, insurance and social status. Livestock keeping is an essential part of the Nigerian economy. About 13 million Nigerian households keep farm animals and the sector contributes 6 to 8 percent of the national GDP (Africa Sustainable Livestock (ASL) 2050, 2018). Food and Agriculture Organisation (FAO, 2010) posits that Nigeria has low animal protein intake with an average of 6g per head per day while the world average is 34g per head per day (FAO, 2010). FAO further asserts that animal protein constitutes only 3% of an average Nigerian meal, as against 12% recommended for healthy living.

The Nigerian poultry industry is made up of about 180 million birds and Nigeria has the second largest chicken population in Africa after South Africa (SAHEL, 2015); producing 650 000 tonnes of eggs and 300 000 tonnes of poultry meat (Central Bank of Nigeria (CBN), 2019 and FAOSTAT, 2017). The Central Bank of Nigeria (CBN, 2019) says the poultry sub-sector is the most commercialized of all Nigeria's agricultural sub-sectors with a current net worth of N1.6 trillion and the sub-sector contributes about 25% of agricultural gross domestic product (GDP) to the Nigerian economy. Poultry production is an important source of animal protein, income generation, employment, industrial raw materials, manure and financial security. Poultry include chicken, turkey, guinea fowl, pigeon, ostriches, quail, peafowl, duck and goose. Poultry refers to chickens kept for the purpose of meat and eggs. Poultry production outnumbers all other forms of livestock production in Nigeria and it thrives well in any part of the country (FAO, 2018). In spite of these important contributions of the poultry industry, Nigerian poultry sector faces high production costs, bio-risks, safety and biosecurity concerns due to lack of sanitary controls and technical constraints in production, processing and marketing. Diseases remain one of the major threats to boosting poultry production in Nigeria (Adewole, 2012). The major diseases are the Newcastle disease, avian influenza, avian pox, etc. (Usman and Diarra, 2008), with Newcastle disease being the most recognized by poultry farmers (Adene and Oguntade, 2006). Poultry farmers all over the world face endemic disease challenges that threaten poultry health, welfare and the profitability of the poultry enterprise. These diseases can have a substantial economic impact on individual enterprises and on the poultry industry as a whole (Wierup, 2012). The incessant outbreak of diseases in the poultry industry has made the practice of biosecurity an essential practice to protect the poultry industry from bio-risks and threats from many disease producing agents and the prevention and control of these diseases depends on the adoption of biosecurity and best management practices.

Biosecurity has multiple meanings and is defined differently according to various disciplines. Koblenz (2010) defined biosecurity as a set of preventive measures designed to reduce the risk of transmission of infectious diseases in crops and livestock, quarantined pests, invasive alien

species, and living modified organisms. FAO (2008) explained biosecurity as management practices to keep diseases out of the flock through designing a combination of systems and practices to prevent the adverse effects of disease. It went further to say that biosecurity is a set of preventive measures designed to reduce the risk of disease transmission. These measures are a combination of systems and practices that are responses to the specific risks faced by producers. Biosecurity encompasses all policy and regulatory frameworks to manage risks associated with food and agriculture (including relevant environmental risks), fisheries and forestry and constitute three sectors (namely food safety and security, plant life and health, and animal life and health). Poultry farm biosecurity ranges from simple, low cost measures such as putting locks on gates to the more costly measures such as using high - pressure water sprayers to clean cars and constructing shower blocks to secure visitors and workers as they enter the farm. Some biosecurity activities are management changes, which may be low cost but require commitment from owners and farm workers to implement successfully. These include allocating a specific worker to a shed and not allowing staff to move from shed to shed. There are several factors that may influence the type of biosecurity measures adopted by broiler and layer poultry farmers.

According to Mandal (2019), the main objective of biosecurity is to protect human health and to increase and protect agricultural produce through the prevention, control and management of biological risk factors. Biosecurity also aims to protect against acts of bioterrorism and to prevent adverse biosecurity events as well as offering advice on appropriate interventions and political and social changes that should be adopted by government regulatory agencies. Biosecurity is a pre-requisite for achieving the aims and objectives stated in the FAO strategic framework for promoting, developing and re-enforcing policy and regulatory frameworks for food, nutrition and environmental security (Paris, 2001). Biosecurity has direct relevance to food security and safety, nutrition security, the conservation of the environment (including biodiversity), and sustainability of agriculture.

Absence or neglect of biosecurity practices in poultry farms can give rise to unprecedented situations like high mortality rate, reduced profit and loss of investment. Therefore, based on the above background information, the broad objective of this study was to ascertain the biosecurity measures adopted by poultry farmers in Imo State, Nigeria. Specific objectives are to: ascertain the socioeconomic characteristics of poultry farmers in Imo State; identify sources of information on biosecurity measures adopted by poultry farmers in Imo State; ascertain biosecurity measures adopted by poultry farmers in Imo State; determine factors influencing adoption of biosecurity practices.

## **METHODOLOGY**

The study was conducted in Imo state, Nigeria. The state is located in South eastern Nigeria. It is bordered by Anambra State to the North, Abia State to the East, Rivers State to the South, and Delta State and River Niger to the West. The state has three agricultural zones, namely; Okigwe, Orlu and Owerri zones and 27 Local Government Areas. The people in the State are

predominantly farmers who engage in food and livestock production and marketing. Animals reared at both subsistence and commercial levels are poultry (broilers, layers), goats, sheep, pigs and fishes (Imo State Govt, 2020).

Descriptive survey research design was adopted. Multistage sampling technique was adopted for the study. In the first stage, 2 Local Government Areas (LGAs) with high number of poultry farmers were purposely selected from each of the agricultural zones, giving a total of 6 LGAs. In the second stage, 2 communities were randomly selected from each LGA, making a total of 12 communities. Thirdly, from each community, 5 poultry farmers were randomly selected from the sampling units in each community, giving a sample size of sixty (60) respondents.

Both primary and secondary data were used for the study. Primary data were collected with structured questionnaire. Secondary data were collected from published and unpublished materials. Both descriptive statistics and binary logistic regression model were used to achieve the stated objectives. The binary logistic regression model is implicitly stated as follows.

$$Y = \text{Ln} (P/1 - P) =$$

$$Y = f (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11})$$

The functional form is expressed in explicit form as:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + \dots U$$

Where:

Y = Dependent binary variable (Adoption of biosecurity measures = 1, Non - adoption = 0)

X<sub>1</sub> = Age (years)

X<sub>2</sub> = Sex (male = 1, female = 0)

X<sub>3</sub> = Marital Status (married = 1, single = 0)

X<sub>4</sub> = Household size (number of persons in the household)

X<sub>5</sub> = Cooperative membership (member = 1, not a member = 0)

X<sub>6</sub> = Poultry experience (number of years in poultry production)

X<sub>7</sub> = Access to training (number of times)

X<sub>8</sub> = Flock size (number of birds)

X<sub>9</sub> = Education (number of years in spent in school)

X<sub>10</sub> = Extension contact (number of visit)

X<sub>11</sub> = Credit access (savings = 1, credit access = 0)

b<sub>0</sub> = Constant

b<sub>1</sub> – b<sub>11</sub> = Regression coefficients

X<sub>1</sub> – X<sub>11</sub> = Independent variables

Ln = Logarithm

P = Probability of Adoption

## **RESULTS AND DISCUSSION**

### **Socio-economic Characteristics of Poultry Farmers in Imo State**

Table 1 shows the socio-economic characteristics of the poultry farmers in Imo State. The Table showed that majority (68.3%) of the poultry farmers are males. The reason for this can be attributed to the fact that poultry farming is labour intensive and so discourage women from engaging in it. This finding is in line with the studies of Alalade *et al.* (2018) in Kwara State, Eze *et al.* (2017) in Enugu State, Ajewole and Akinwumi (2014) in Ekiti State, Bakare (2013) in Ose Local Government Area of Ondo State and Maikasuwa and Jabo (2011) in Sokoto State, Nigeria, who reported in their separate studies that poultry farming is dominated by the male folk.

Majority (50%) of the respondents were between the ages of 41 – 50 years and the mean age of respondents was 45 years. The respondents are mainly middle-aged farmers who are still active, productive and vibrant and are more likely to adopt innovations faster than others in the other age brackets. Poultry farming is labour intensive and requires younger farmers who can cope with the tedious and rigorous biosecurity practices including disease management. This finding is in consonant with Eze *et al.* (2017) and Ibekwe *et al.* (2015).

The study revealed that majority (80%) of the poultry farmers in the State are married. This means they have family responsibilities and should be committed to the biosecurity practices of their poultry enterprises so as not to reduce their farm income and profits. The table further showed that majority (71.7 %) of the respondents were well educated and are more likely to adopt innovations and biosecurity measures faster than others. High educational attainment is very essential, since practice of biosecurity and disease management requires some level of literacy and technical knowledge and also education enhances the farmers' productivity, accountability and profitability of the farm business. This finding is in agreement with Eze *et al.* (2017) and Ibekwe *et al.* (2015).

The result showed also, that the average household size is seven (7) persons. The average household size of the respondents is above national average of 5 persons in Nigeria (NBS, 2009). This large household size implies available labour for the poultry farm. The mean poultry farming experience of farmers in the study area is 17 years. This number is quite reasonable for any significant biosecurity improvement and achievement by the respondents in the study.

Survey results as presented in table 1 also shows that majority of the poultry farmers (60%) in the study area belong to cooperative groups. Poultry farmers use the opportunity of being members of cooperative groups to interact and obtain information on how to improve the biosecurity of their farms. According to Ekong (2010), association with cooperative groups helps farmers to satisfy their innate need of solving their problems through collective efforts. Table 1 shows also that about 53.3% of the respondents have no access to farm credit; this may

bedueto the fact that they are rarely considered as credit worthy because they have no collateral (Yisehak,2008). The farmers that have access to credit may be due their membership of cooperative groups.

Table 1 further showed that most (75%) of the respondents have their enterprise objective as profit making (commercial). With profit motive as their enterprise objective, the poultry farmers would do everything possible to get information and practice biosecurity measures that would help them maximize their profit. This finding is agreement with Maduka, Igbokwe and Atsanda (2016). Also, majority (58%) of the respondents keep less than 1000 birds in their farms and the mean flock size was 258 birds in the study area. This shows that poultry farmers in Imo State are micro and small-scale poultry farmers. This finding is in line with FAO (2008) and Agbola (2014).

The result also showed that most (51.7%) of the respondents use deep litter system of poultry management. In the deep litter system, poultry birds have direct contact with their faecal matter. This implies high risk of infection and disease, which will result in high medication costs, increasing the overall cost of production Eze *et al.* (2017). In the battery cage system, the poultry droppings fall on the floor beneath the cages so the poultry birds have no contact with their faecal matter. This helps to reduce health risks and expenditure on drugs (Ayadole, 2016). Table 1 additionally, showed that majority (71.7%) of the poultry farmers had training in Livestock management and /or veterinary science. Also majority (90%) of the respondents did not receive any agricultural extension visit/services for the past two years up to the date of data collection.

### **Sources of information on biosecurity measures adopted by poultry farmers Imo State**

Table 2 shows the sources of information on biosecurity measures adopted by poultry farmers in Imo State. The result showed that farmers association ranked 1<sup>st</sup> (86.7%) as a source of information on biosecurity measures. Veterinary officers ranked 2<sup>nd</sup>. Internet and researchers ranked 3<sup>rd</sup> and 4<sup>th</sup> as sources of information on biosecurity. Othersourcesofinformation onpoultry biosecurity practices news media (5<sup>th</sup>), books/magazines (6<sup>th</sup>), seminar/workshops (7<sup>th</sup>), family and friends (8<sup>th</sup>), extension workers (9<sup>th</sup>), ministry of agriculture (10<sup>th</sup>) and feed and drug sellers (11<sup>th</sup>). Table 2 shows that poultry farmers in the study area have access to information on biosecurity practices from various sources. Correct and adequate information enhances a farmer's ability to make sound decision on matters regarding biosecurity in his farm (FAO, 2008). Maningaset *al.* (2005) and FAO (2008) opine that effective information, training, awareness and efficient delivery system of relevant information and technology services facilitates the poultry farmers' critical role in decision-making towards enhanced production, processing and marketing of poultry products.

### **Biosecurity measures adopted by poultry farmers in Imo State**

The level of adoption of biosecurity measures by the poultry farmers in the study area is

presented in Table 3. The table showed that all the respondents adopted the biosecurity measures listed above at different levels of adoption. Notwithstanding, only 14 biosecurity measures out of the 27 measures listed recorded 100% positive and significant response while the other 13 measures recorded various levels of response though positive and significant as presented in the table.

### **Socio – economic factors influencing biosecurity practices in Imo State**

Table 4 shows the result of the binary logit regression analysis of the factors influencing the adoption of biosecurity practices. The result showed that age, cooperative membership, poultry experience, formal training, farm size, educational qualification and credit significantly influenced the adoption of biosecurity practices in the study area. Any increase in the level of these variables would increase the level of adoption of biosecurity practices in the study area. The Chi<sup>2</sup> of 7.227 (df = 11) for model coefficient indicated socio – economic factors included in the model were significantly related to adoption of biosecurity measures in Imo State. The table shows that the value of Pseudo R<sup>2</sup> of the binary logit regression model was 0.625 which shows that the socio - economic variables included in the model had very good predictive ability because R<sup>2</sup> of 0.625 is close to 1, indicating very good predictive ability and 1 – R<sup>2</sup> error term.

### **CONCLUSION**

Based on the result of the study, majority of the poultry farmers in the study area were male and married and these farmers were still in their active and productive age and were educated. From the findings, most of the poultry farmers in the study area were micro and small scale farmers and have considerable experience in poultry production and are members of farmers groups with profit motive as their farming enterprise objective. Farmers associations, veterinary officers, Internet and researchers are the significant sources of information on biosecurity to the poultry farmers in the study area. Age, cooperative membership, experience in poultry farming, formal training, farm size, educational qualification and access to credit significantly influenced the adoption of biosecurity practices in the study area. Any increase in the level of these variables would increase the level of adoption of biosecurity practices in the study area.

### **RECOMMENDATION**

Efforts should be made by government and relevant stakeholders to factor biosecurity measures into policies and decisions that will encourage and motivate smallholder poultry farmers to adopt biosecurity measures in their farms and agricultural extension services should be strengthened in the study area, seeing that it is non – existent to take charge of its primary responsibility of education, enlightenment and training of the poultry farmers on biosecurity innovations for disease prevention and control.

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## APPENDIX

**Table 1: Socio - economic characteristics of poultry farmers in Imo State**

Variables	Freq.	%	Mean
<b>Sex</b>			
Male	41	68.3	
Female	19	31.7	
<b>Total</b>	<b>60</b>	<b>100.0</b>	
<b>Age</b>			
21 - 30	5	8.3	
31 - 40	8	13.3	45
41 - 50	30	50.0	
51 - 60	13	21.7	
61 - 70	4	6.7	
<b>Total</b>	<b>60</b>	<b>100.0</b>	
<b>Marital Status</b>			
Single	7	11.7	
Married	48	80.0	
Widow(er)	5	8.3	
<b>Total</b>	<b>60</b>	<b>100.0</b>	
<b>Level of Educational (Years)</b>			
Primary Education	3	5	
Secondary Education	14	23.3	
Tertiary Education	43	71.7	
<b>Total</b>	<b>60</b>	<b>100.0</b>	
<b>Household Size</b>			
1 - 5	15	25.0	
6 - 10	40	66.7	7
11 - 15	5	8.3	
<b>Total</b>	<b>60</b>	<b>100.0</b>	
<b>Farming Experience (Years)</b>			
1 - 10	10	16.7	
11 - 20	32	25.0	17
21 - 30	13	43.3	
31 - 40	05	15.0	
<b>Total</b>	<b>60</b>	<b>100.0</b>	
<b>Cooperative Participation</b>			
Yes	36	60.0	
No	24	40.0	
<b>Total</b>	<b>60</b>	<b>100.0</b>	
<b>Access to Credit</b>			
Yes	28	46.7	
No	32	53.3	
<b>Total</b>	<b>60</b>	<b>100.0</b>	
<b>Enterprise Objective</b>			
Commercial	45	75.0	
Family Consumption	1	1.67	
Both	14	23.3	
<b>Total</b>	<b>60</b>	<b>100</b>	

<b>Flock Size</b>			
1 - 200	33	55.0	258
201 – 400	20	33.4	
401 – 600	5	8.3	
601 – 800	2	3.3	
<b>Total</b>	<b>60</b>	<b>100.0</b>	
<b>Poultry Management System</b>			
Deep litter system	31	51.7	
Battery cage system	18	30.0	
Both	11	18.3	
<b>Total</b>	<b>60</b>	<b>100.0</b>	
<b>Training in poultry production</b>			
Yes	43	71.7	
No	17	28.3	
<b>Total</b>	<b>60</b>	<b>100.0</b>	
<b>Extension visits</b>			
Yes	6	10.0	
No	54	90.0	
<b>Total</b>	<b>60</b>	<b>100.0</b>	

Source: Field Survey, 2019

**Table 2: Sources of Information on biosecurity measures adopted**

<b>Information Source</b>	<b>frequency</b>	<b>percentage</b>	<b>Rank</b>
Farmers Association	52	86.7	1 <sup>st</sup>
Veterinary officers	45	75.0	2 <sup>nd</sup>
Internet	43	71.7	3 <sup>rd</sup>
Researchers	40	66.7	4 <sup>th</sup>
News media (print and electronic)	39	65.0	5 <sup>th</sup>
Books/ magazines	38	63.3	6 <sup>th</sup>
Seminar/Workshop	20	33.3	7 <sup>th</sup>
Family and Friends	15	25.0	8 <sup>th</sup>
Extension workers	8	13.3	9 <sup>th</sup>
Ministry of Agriculture	5	8.3	10 <sup>th</sup>
Feed/Drug Sellers	3	5.0	11 <sup>th</sup>

Source: Field Survey, 2019

Multiple responses recorded

**Table 3: Biosecurity measures adopted by poultry farmers in Imo State**

Biosecurity Measures	Frequency	Percentage
1. Limit non – essential human traffic on the farm	57	95.0
2. Restraining farm workers from visiting other farms	55	91.7
3. Keep other animals out of poultry building	60	100.0
4. Isolation of infected birds	60	100.0
5. Quarantine of new birds	58	96.7
6. Avoid mingling flock with local, wild/migratory birds	55	91.7
7. Examine flocks daily for disease symptoms	60	100.0
8. Keep a record of all farm visitors	60	100.0
9. Keeping birds of different ages separately	59	98.3
10. Selling crates along with eggs	56	93.3
11. No recycling of feed bags	55	91.7
12. Providing foot-dip with disinfectant	60	100.0
13. Separation of birds according to age	60	100.0
14. Proper washing and disinfection of feeding/water troughs	60	100.0
15. Ensure adequate ventilation for the birds	60	100.0
16. Constant cleaning of litter	60	100.0
17. Burying or burning of dead birds	60	100.0
18. Keeping areas around poultry house/feed bins clean to keep rodents away	60	100.0
19. Avoiding overcrowding	57	95.0
20. Ensure adequate floor spacing	57	95.0
21. Adequate feeding and drinking troughs	60	100.0
22. Fumigate poultry house and equipments before stocking	58	96.7
23. Separate transport for eggs and birds	55	91.7
24. Wash hands before and after handling poultry birds/products	60	100.0
25. Adequate light source for the birds	56	93.3
26. Regular vaccination of birds	60	100.0
27. Have only one entrance/exit	50	83.3

Source: Survey data, 2019

**Table 4: Factors influencing biosecurity practices in Imo State**

Variables	Coefficient	Standard error	Z – value
Constant	60.67 *	21.36	2.84
Age	0.68*	0.04	1.72
Sex	- 0.04	0.03	- 1.10
Marital status	0.17	0.16	1.09
Household size	- 0.35	0.04	- 0.98
Cooperative membership	0.04*	0.02	1.95
Poultry experience	0.03**	0.13	2.30
Formal training	0.27**	0.10	2.70
Flock size	0.34**	0.15	2.27
Educational qualification	0.65*	0.37	1.80
Extension contact	0.21	0.24	0.87
Credit access	0.56*	0.31	1.78
MC Fadden Pseudo R <sup>2</sup>	0.625		
Chi <sup>2</sup>	7.227		
Log likelihood function	-54. 364		

Source: Survey data, 2019

\*\* Significant at 5%, \* Significant at 10%